AMERICAN BEE JOURNAL.

EDITED AND PUBLISHED BY SAMUEL WAGNER, WASHINGTON, D. C.

VOL. II. OCTOBER, 1866. No. 4.

Memoir of Huber.

The naturalist whose researches have been specially directed to the instinct and operations of the domestic honey bee, will be strongly disposed to regard the subject of this memoir as at the very head of apiarian science, and his writings as forming the safest and most useful text-book. Multitudes have written on this department of natural history, and have added more or less to a knowledge of what has been a subject of investigation for ages. But none, either in ancient or modern times, have displayed so much sagacity of research as FRANCIS HUBER, nor so much patient perseverance and accuracy of experiment, even admitting some errors of minor importance detected by succeeding observers. His success in discovery, notwithstanding the singular difficulty he had to struggle with, was proportioned to his diligence and acuteness; and this difficulty arose, not from what some of his advocates have, in their zeal in his defense against the sneers of the sceptical, termed "imperfect vision," but from *total blindness*. For, from the period when he first applied himself in good earnest to investigate, the nature of his winged favorites, external nature presented to his eyes one universal blank:

"So thick a drop serene had quenched their orbs."

It is not, therefore, without reason that his friend and eulogist, De Candolle, asserts that "nothing of any importance has been added to the history of bees since his time; and naturalists of unimpaired vision have nothing of consequence to subjoin to the observations of a brother who was deprived of sight."

FRANCIS HUBER was born at Geneva on the 2d of July, 1750. His father possessed a decided taste for subjects of natural science; the son inherited the taste of his father; and, even in his boyish days, pursued his favorite studies with such intense ardor as materially to injure his health, and bring on that weakness in his visual organs which eventually ended in total blindness. His attention had been led to what became his favorite—and indeed his sole and engrossing study, the habits and economy of the honey bee, by his admiration of the writings of Reaumur, and, above all, by his acquaintance with Bonnet, the illustrious author of the "Contemplations of Nature," who quickly discerned the intelligence and penetration of his young friend, and who kindly and strongly encouraged him in his peculiar researches. It is singular enough that these two distinguished naturalists and friends should both have labored under a similar personal defect, occasioned, too, by the same causes; for the same intenseness and minuteness of observation which deprived Huber of sight altogether, had brought on in Bonnet a weakness of vision which for a time threatened total blindness, and from which he never fully recovered.

It will readily occur to every one that the loss of sight in Huber must not only have presented a very serious obstacle to the successful study of his favorite science, but must have had the effect, also, of throwing considerable doubt on the accuracy of his experiments and the reality of his discoveries. His most devoted admirers and most unhesitating followers in every thing connected with the economy of bees, are bound in candor to acknowledge that his observations, reported, as they were, as second-hand, and depending for their accuracy on the intelligence and fidelity of a half-educated assistant, were of themselves not entitled to be received without caution and distrust. Francis Burnens, his assistant, had no doubt entered with enthusiasm into the pursuits, and appears to have conducted the experiments not only with the most patient assiduity, but with great address and no small share of steadiness and courage—qualities indispensable in those who take liberties with the *genus irritabile apum*. Still, Burnens was but an uncultivated peasant when he became Huber's hired servant, and possessed none of those acquired accomplishments which serve to sharpen the intellectual faculties, and fit the mind for observing and discriminating with correctness. It cannot reasonably excite our wonder, therefore, that on the first appearance of Huber's observations, the literary, or rather the scientific world, was somewhat startled, not

only at the novelty of his discoveries, but also at the instrumentality by which they had been effected. Huber, however, had taken great pains in cultivating the naturally acute mind of the young man, in directing his researches, and accustoming him to rigorous accuracy in his observations. And the fact that a glimmering of many of the discoveries reported by the assistant to his master, had presented themselves to the minds of Linnæus, Reaumur, and other preceding observers, should so far satisfy us that they were not brought forward merely to support a preconceived theory (of what, it is probable that Burnens had no idea,) nor owed their origin to a vivid and exuberant imagination. At a future period Huber was deprived of this valuable coadjutor; but the loss was more than compensated, and accuracy in experiment and observation, if possible, still more unquestionably secured, by the assistance and cooperation of his son, P. Huber, who has given so much delight to the lovers of natural history by his "Researches Concerning the Habits of Ants."

But, whatever hesitation may arise in our minds from the fact of Huber's discoveries not being the result of his personal observation, no doubt can reasonably remain as to such of them as have been repeatedly confirmed and verified by subsequent observers. And this has actually taken place, and holds strictly true as regards the most important of them. His discoveries respecting the impregnation of the queen bee—the consequences of retarded impregnation—the power possessed by the working bees of converting a worker larva into a queen, a fact, though not originally discovered by Huber, yet, until his decisive experiments and illustrations, never entirely known or credited—the origin of wax, and the manner of its elaboration—the nature of propolis—the mode of constructing the combs and cells—and of ventilating or renovating the vitiated atmosphere of the hives—these, and a variety of other particulars of inferior moment, have almost all been repeatedly verified by succeeding observers, and many of them by the writer of this brief memoir. It is readily admitted that some of his experiments, when repeated, have not been attended with the results which he led us to expect; and some incidents in the proceedings of the bees stated as having been observed by him or his assistant, have *not yet* been witnessed by succeeding observers. But in some of them the error may have been in the repetition; in others, the result, even under circumstances apparently the same, may not always be uniform, for the instinct of bees is liable to modification; and in some he doubtless *may be*, and probably *is* mistaken. In passing judgment, however, on his reported discoveries, we ought to keep in view that the author of them has thrown more light on this portion of natural history, and pursued it with more assiduous and minute accuracy, than all the other naturalists taken together, who have turned their attention to the same pursuits; and that therefore nothing short of the direct evidence of our senses, the most rigid scrutiny, and the most minute correctness of detail in experiment, can justify our denouncing his accuracy, or drawing different conclusions. His experiments were admirably fitted to elicit the truth, and his experiences so strongly logical, as to afford all reasonable security against any very important error.

Huber's "New Observations on Bees," addressed in the form of letters to his friend Bonnet, appeared in 1792, in one volume. In 1814 a second edition was published at Paris, in two volumes, comprehending the result of additional researches on the same subject, edited in part by his son. An English version appeared in 1806, and was very favorably noticed in the *Edinburgh Review*. A third edition of this translation was published in Edinburgh in 1821, embracing not only the original work of 1792, but also the several additions contained in that of 1814, and which had originally made their appearance in the *Bibliothèque Brittannique*. These additional observations were, On the Origin of Wax, On the Use of Farina or Pollen, On the Architecture of Bees, and on the precautions adopted by these insects against the ravages of the Sphinx Atropos or Death-head Moth.

To enlarge on the personal character and domestic circumstances of Huber, falls not strictly within our province, which embraces only, or chiefly, his character and writings as a naturalist. There are, however, some features in his disposition and some circumstances in his personal history, dwelt upon at considerable length by De Candolle, which appear so well worthy the attention of our readers, that we cannot forego the opportunity of detailing them, though necessarily in an abridged form. His manners were remarkably mild and amiable—as is frequently found to be the case with those who are afflicted with total blindness—and his conversation animated and interesting. "When any one," says his friend, "spoke to him on subjects which interested his heart, his noble figure became strikingly animated, and the vivacity of his countenance seemed by a mysterious magic to animate even his eyes, which had so long been condemned to blindness." It appears that some of his friends would gladly have persuaded him to try the effect of an operation on *one* of his eyes, which seemed to be affected only by simple cataract; but he declined the proposal, and bore not only without complaint, but with habitual cheerfulness, his sad deprivation. His marriage with Maria Aimée Lullin, the daughter of a Swiss magistrate, was in a high degree romantic. The attachment had began in their early youth, but was opposed by the lady's father, on the ground of Huber's increasing infirmity, for even then the gradual decay of his organs of vision was become too manifest. The affection and devotedness of the young lady, however, appeared to strengthen in proportion to the helplessness of their object. She declared to her parents, that although she would have readily submitted to their will, if the man of her choice could have done without her; yet as he now required the constant attendance of a person who loved him, nothing should prevent her from becoming his wife. Accordingly, as

soon as she had attained the age which she imagined gave her a right to decide for herself, she, after refusing several brilliant offers, united her fate with that of Huber. The union was a happy one. Their mutual good conduct soon brought about the pardon of their disobedience. In the affection and society of his amiable and generous-minded wife, the blind man felt no want; she was "eyes to the blind"—"his reader—his secretary and observer"—a sharer in his enthusiasm on the subject of natural science; and an able assistant in his experiments. She was spared to him forty years. "As long as she lived," said he in his old age, "I was not sensible of the misfortune of being blind." The last years of his life were soothed by the affectionate attentions of his married daughter, Madame de Molin, whose residence was at Lausanne, and to which place he had removed.

It was about this period that he learned the existence in Mexico of bees without stings; and he was, by the kind exertions of a friend, soon after gratified with the present of a hive of that species. To him, whose life had been almost exclusively devoted to the study and admiration of these insects, we may conceive how great a source of enjoyment this gift must have proved. His feeling toward his bees was not a feeling of fondness in an ordinary degree; it was a *passion*, as it almost invariably becomes with every one who makes it his study.

The days of Huber were now drawing to a close. In the full possession of his mental faculties, he was able to converse with his friends with his accustomed ease and tranquility, and even to correspond by letters with those at a distance, within two days of his death. He died in the arms of his daughter on the 22d of December, 1831, in the eighty-first years of his age.—*W. Dunbar.*

By a law of nature from which bees seldom deviate; the foundation of the second comb is laid parallel to the first, and the succeeding combs are generally parallel to each other. There is usually an interval of a little more than a third of an inch between the range of comb, and this for substantial reasons. Were they too distant, it is evident that the bees would be greatly dispersed, and unable to communicate their heat, reciprocally, whence the brood would not receive sufficient warmth. Were the combs too close, on the contrary, the bees could not freely traverse the interspace, and the work of the hive would suffer.

Pollen, or bee bread, as it was formerly called, is collected by the bees mainly for the purpose of feeding their young brood. It contains none of the elementary principles of wax; and the prevalent notion that wax is made of it, is entirely unfounded and erroneous.

Nothing is more offensive to bees than the human breath. You may gently fan them, or blow upon them with a bellows, without offence; but breathing on them excites their rage instantly.

The Senses of Bees.

Much uncertainty has prevailed on the subject of the senses possessed by the honey bee; not so much, perhaps, in regard to the *existence* as to the *locality* of the organs. Most naturalists admit their possession of five senses, analogous to those of men, though the celebrated Huber seems to have some doubt as to the existence of the faculty of hearing in bees, at least without some important modifications. Greater diversity of opinion, however, prevails as to the *situation* of those organs by which the impressions of sight, touch, taste, sound, and smell are produced on their sensations; and many curious experiments by different naturalists have been made with a view to ascertain the truth, but which have not always led to the same results. In researches so minute, it is perhaps vain to look for perfect accuracy in our conclusions, and we must be satisfied with anything like reasonable approximation to the truth.

Sight.—In the anatomical structure of the head of the bee, besides the reticulated eyes placed, as in other animals, on the sides of the head, this insect possesses three *stemmata* or coronetted eyes, arranged triangularly on its centre between the antennæ. That these little specks are, in reality, organs of vision, has been made apparent from accurate experiments, in which, when the reticulated eyes were blindfolded, the insect was evidently not deprived of its sight, though the direction of its flight, being vertical, seemed to prove that the stemmata were adapted only or chiefly for upward vision. This additional organ must doubtless add considerably to its power of sight, though, probably, its aid may be confined chiefly to the obscure recesses of the hive. As the internal operations of the insect in the honey season are carried on during the night as well as the day, the coronet eyes may, as Reaumur conjectures, serve to it the purpose of a microscope. As to the general power of vision in a bee, its organs appear better adapted to distant objects than to such as are close at hand. When returning loaded from the fields, it flies with unerring certainty, and distinguishes at once its own domicile in the midst of a crowded apiary. Yet any person who has at all made this insect the subject of observation, must have seen it often at a loss, in returning to its hive, to find the entrance, especially if its habitation has been shifted ever so little from its former station; nay, if without moving the hive the entrance has been turned round a single inch from its former position, the bee flies with unerring precision to that point on the alighting board where the door formerly stood, and frequently, after many fruitless attempts to find the entrance, it is forced to rise again into the air, with a view, we may suppose, of removing to such a distance from the desired object as is suited to the properties or focus of its visual organ. We are led to conclude, therefore, from these well-known facts, that the eye of the bee has a lengthened focus, and that it must depend on the aid of other organs in those operations

wherein its attention is directed to objects close at hand.

Feeling or Touch.—The organs of this sense are supposed, with reason, to reside in the antennæ and palpi or feelers, particularly in the former. Huber concludes that the antennæ supply the want of sight in the interior of the hive, and that solely by their means they are enabled to construct their combs in darkness, pour their honey into the magazines, feed the young, judge of their age and necessities, and recognize their queen. Though it does by no means appear clear that the bees are devoid of sight when employed in their indoor operations—though, on the contrary, there is reason to believe, as already stated, that the stemmata or ocelli serve as orbs of vision—this naturalist is probably not wrong in ascribing to the antennæ an important share in these operations. That the bees use them as a means of communication and recognition, seems readily admitted by apiarians. When a hive has lost its queen, the event, as may well be supposed, causes a high degree of agitation in the colony; the disturbed workers, who have first, by some unknown means, acquired the knowledge of this public calamity, soon quit their immediate circle, and, "meeting their companions," says Huber, "the antennæ are reciprocally crossed, and they slightly strike them." The communication made by these means is quickly disseminated, and in a few minutes the whole colony is in a state of agitation and distress. Of the antennæ being employed as instruments of recognition, the same naturalist gives a striking instance, which our limits prohibit us from quoting in his own words. Suffice to say here, that by means of a wire grating, wide enough only to admit the circulation of air, inserted in the middle of the hive, he separated the queen from the half of her subjects, and ascertained that neither sight, hearing, nor smell made the near neighborhood of their sovereign known to them, for they proceeded to rear a new queen from the larva of a worker, as if the other were irrecoverably lost. But when he substituted a grating wide enough to allow the transmission of the antennæ, all went on as usual, for the bees soon ascertained by these organs the existence of their queen.*

Another important use which the bees make of this organ deserves notice. "Let us follow their operations by moonshine, when they keep watch at the opening of the hive to prevent the intrusion of the moths then on the wing. It is curious to observe how artfully the moth knows how to profit to the disadvantage of the bees, which require much light for seeing objects, and the precautions taken by the latter in reconnoitering, and expelling so dangerous an enemy. Like vigilant sentinels, they patrol round their habitations with their antennæ stretched out straight before them, or turning to right and left; woe to the moth if it cannot escape their contact; it tries to glide along between the guards, carefully avoiding their flexible organs, as if aware that its safety depended on its caution."

Taste.—In bees, taste appears on a slight view, to differ most materially from that sense in man; and because with all their eager fondness for the rich nectar of flowers, they are frequently detected in lapping the impure fluid from corrupted marshes, it has been hastily concluded that their sense of taste is very defective. Huber thought it the least perfect of the bee senses, and instances their gathering honey even from poisonous flowers, and regaling themselves with fœtid liquids. Now, with deference to this distinguished observer, it may be permitted, perhaps, to defend our favorites from so injurious an imputation. We have *prima facie* evidence of the delicacy of their taste in their eager activity in collecting their delicious stores of honey secreted by the most fragrant flowers; and such is their ardor in these operations, that they defy the elements when the honey season is at its height, and, by laying aside their usual fear of bad weather boldly encounter wind and rain to get at their favorite fluid. Huber acknowledges that when "the lime tree and black grain blossom, they brave the rain, depart before sunrise, and return later than ordinary. But their activity relaxes after the flowers have faded; and when the enamel adorning the meadows has fallen under the scythe, the bees remain in their dwelling, however brilliant the sunshine." Wherefore have they not, in this decline of the flowering season, recourse to the foul marsh and slimy pool, which they are charged with frequenting? Simply because the purposes for which they did frequent these unwholesome liquids have already been answered. The truth is, the bees have recourse in spring, but generally speaking in spring only, to dunghills and stagnant marshes, for the sake of the salts with which they are impregnated, and which their instinct teaches them are advantageous to their health after their long winter confinement. If we place before the bees a portion of honey, and a portion of liquid drawn from a corrupt source, their choice will completely vindicate the purity of their taste and their power of discrimination in the selection of their food.

It is not meant to be denied, however, that the sense of taste in bees is ever at fault. This would be going in the face of some well authenticated instances of honey being injured, and even rendered dangerous, in consequence of the bees feeding on noxious plants. Towards the close of the year, when flowers become scarce, and in those parts of the country where alders abound, and where onions and leeks are cultivated on a large scale and allowed to run to seed, the bees, from taste, or from necessity, or from an anxiety to complete their winter stores, are seen to feed on the blossoms of these plants, which communicate to the honey a very disagreeable flavor. But this is not all. The fact stated by Xenophon, in the retreat of the Ten Thousand, and confirmed by Diodorus Siculus, proves that there are plants in Asia Minor which give to the honey not only disagreeable, but poisonous qualities. He tells us that the sol-

*This is not conclusive evidence, as the workers will construct royal cells at times, when their queen is simply confined in a cage in their hive.

diers, having eaten a quantity of honey in the environs of Trebizonde, were seized with vertigo, vomitings, &c. This effect was attributed to the rose-laurel (Rhododendron Ponticum,) and yellow azalea (Azalea Pontica). Father Lamberti also assures us that a shrub of Mingrelia produces a kind of honey which causes very deleterious effects. It is quite possible that the poisonous juices extracted from these plants might be innoxious to the bees themselves, and thus the correctness of their taste might be so far vindicated. Sir I. E. Smith asserts that "the nectar of plants is not poisonous to bees;" and an instance is given in the American Philosophical Transactions, of a party of young men, who, induced by a prospect of gain, having removed their hives from Pennsylvania to the Jerseys, where there are vast savannahs, finely painted with the flowers of the Kalmia angustifolia, could not use or dispose of their honey on account of its intoxicating quality; yet "the bees increased prodigiously"—an increase only to be explained, says Dr. Bevan, in his Honey Bee, by their being well and *harmlessly* fed. Nor is this defense of the taste of the bees successfully controverted by the following occurrence stated in Nicholson's Journal: "A large swarm of bees having settled"—observe they had merely lighted upon it, to rest perhaps after a long flight—"on a branch of the poison ash, (Rhus Vernix,) in the county of Westchester, in the State of New York, was put into a hive and removed to the place where it was to remain. Next morning the bees were found dead, swelled to double their natural size, and black, except a few which appeared torpid and feeble, and soon died on exposure to the air." This was attributed to their being poisoned, not by their having fed upon, but by the *effluvia* of the Rhus Vernix.

HEARING.—Cousiderable difference of opinion has prevailed among naturalists, both as to the existence of this sense in bees, and the situation of the organ. Aristotle was doubtful whether bees possess this sense. "Incertim est an audiant." Linnæus and Bonnet denied them the faculty, and Huber seems undecided on the point; while a host of others, among whom are ranked Kirby and Spence, maintain its existence, and place the organ in the antennæ. We know that the bees *dislike noise*, for an apiary situated near mills, smitheys, or other noisy workshops, is seldom prosperous. The different modulations of sound produced by the wings in flying, seem intended as a means of communication addressed to the organ of hearing, as signals of attack, recall, of departure, &c. In consequence of a belief in the reality of this sense in bees, the practice is common of beating sonorous bodies at the moment of swarming, in order to prevent them from communicating with one another, and thus present an obstacle to their flying away. We know, also, that many other insects possess this faculty; and as we observe in the proceedings of the bees, the same effects which in other insects unquestionably proceed from the sense of hearing, we regard these effects as presumptive evidence of the former possessing the same faculty. Huber sets out with intimating a doubt of its existence—possibly in deference to his friend Bonnet, to whom his letters are addressed, and who was an unbeliever in its reality—yet in the end confesses that he is strongly tempted to believe in it, or at least to admit in bees a sense *analogous* to hearing, observing that certain sounds, as produced by bees, apparently serve as a signal to their companions, and are followed by regular consequences, and that, therefore, they may be additional means of communication to those afforded by the antennæ. He mentions particularly a sound emitted by the queen, which produces a paralyzing effect on the bees in certain circumstances. Describing the attempts of a reigning queen to destroy her rivals while yet in the cells, he tells us that "the bees on guard pulled her, bit her, and chased her away." In these circumstances she emitted the sound alluded to; "standing, while doing so, with her thorax against a comb, and her wings crossed on her back, in motion, but without being unfolded or farther opened. Whatever might be the cause of her assuming this attitude, the bees were affected by it; all hung down their heads and remained motionless." On another occasion, after a queen had put her rival to death, "she approached a royal cell, and took this moment to utter *the sound*, and assume that posture which strikes the bees motionless." This discovery of Huber has been brought forward, on his authority, by naturalists, as a conclusive evidence of the existence of the auditory faculty in bees. And so it would be, if Huber was not mistaken in his supposed discovery. A voice of sovereignty producing such powerful and instantaneous effects on her subjects, is so remarkable a property of her bee-majesty, that it would be desirable to have its existence proved beyond doubt by succeeding experiments. With much confidence in the accuracy of that distinguished naturalist's observations, we entertain some hesitation on the subject of this magical sound. We have seen the queen in all the circumstances and in all the positions observable within a hive; (with one exception, namely, combating a rival queen,) we have observed her majesty very frequently in the particular situation described by Huber when he first heard the commanding voice, endeavoring to tear open the cell of a rival, and angrily repulsed by the workers; then standing at a little distance on the surface of the comb, with her wings crossed over her back, and in motion, though not fully unfolded, and emitting the clear, distinct sound which is heard in a hive a day or two previous to the departure of a second swarm; and certainly we never witnessed any such effect produced on the bees as Huber speaks of, and which, had it taken place, could not possibly have escaped our observation. On the contrary, the bees seemed not in the slightest degree affected by her wrath, for she was evidently in a state of great irritation, but continued to surround the cell of the captive queen with a dogged-looking obstinacy, apparently expecting or prepared for another attempt on it by the enraged sovereign. Huber may be in the right, and his general accuracy affords a presumption in his favor; nevertheless

it would be very satisfactory to have his accuracy in this particular point confirmed by some other observer. Taking it for granted that the sense of hearing does exist in bees, where are we to look for the situation of the organ? Naturalists are not agreed on this point, but the majority seem to vest it in the antennæ. Kirby and Spence notice the analogy borne by antennæ to the ears of vertebrate animals, such as their corresponding in number, and standing out of the head; and observe that no other organ has been found which can be supposed to represent the ear. In that case this appendage of the head of the bee must be regarded as a compound organ, exercising the functions of both *hearing* and *touch*. It has already been hinted that some observers have regarded it as an organ of *vision;* and we shall afterwards find that there are those who look upon it as an organ of *smell*. In this deficiency of precise knowledge on the subject, we may, perhaps, rest satisfied with the opinion of Kirby, that "the antennæ by a peculiar structure, may collect notices from the atmosphere, receive pulses or vibrations, and communicate them to the sensorium, which communications, though not precisely to be called *hearing*, may answer the same purpose." The same author gives an anecdote of another insect, which goes to prove that the antennæ are indeed the organs of this sense: "A little moth was reposing on my window; I made a quiet, not loud, but distinct noise; the nearest antennæ moved towards me; I repeated the noise at least a dozen times, and it was followed every time by the same motion of that organ, till at length the insect being alarmed, became agitated and violent in its motions. In this instance it could not be *touch*, since the antennæ were not applied to a surface, but directed towards the quarters from which the sound came, as if to listen."

Smelling.—Of all their senses, that of smell in bees is the most acute. Attracted by the fragrance of flowers, we see them winging their eager way to a very considerable distance, in a straight, undeviating course, and in the very teeth of a strong wind, in search of those plants which promise an abundant honey harvest. Very striking proofs of the acuteness of this sense may be observed within the limits of the apiary. Early in spring when the bee-master begins feeding his colony, he has reason to marvel at the instantaneous notice which this organ gives them of his approach. Amongst his hives, though from the chilliness of a spring morning, not a bee is seen stirring out of doors, he has not time to fill the feeding-trough from the vessel in his hand, before he is surrounded by hundreds; and in the space of five minutes or less, the float-board of every trough is covered with a dense mass of eager feeders. In feeding a newly lodged swarm during unfavorable weather in summer, it is curious to observe through the glass, in pushing the sliding trough which runs flush with the floor, the motionless hemispherical mass at the ceiling of the hive, becoming instantaneously elongated, and changed into the form of an inverted pyramid, having its apex resting on the float-board, while a score or two of stragglers, who have in the confusion been separated or have fallen from the mass above, hasten along the floor, snuffing the grateful fragrance, ranging themselves in a line on the edge of the trough, and eagerly plunging their probosces into the liquid. It is to their exquisite sense of smell, also, in all likelihood, that we must attribute their capability of distinguishing friend from foe among their own species. If a stranger-bee by mistake enter a hive, and this sometimes happens in consequence of some slight alteration in the arrangement of the apiary, his close resemblance to his fellow insects will not secure him from an immediate attack from all quarters; he is detected by a more subtle sense than vision, and instant flight alone can save him. Huber, to whose researches we are so much indebted in regard to the senses of bees, made some very conclusive experiments on that of smell, all of which we have repeated with precisely the same results. Like his, our first experiment was to ascertain the acutenes of the sense. We concealed a vessel with honey behind the shutters of an open window, near the apiary. In our experiment, a small box containing a portion of honey mingled with ale, and covered with a piece of wire gauze, was placed at a distance of a hundred yards from the apiary, close to the bottom of a hedge, where it was by no means conspicuous. In a quarter of an hour, a bee alighted on the box, and in a few minutes more, while this bee was eagerly exploring and striving to gain an entrance, several more joined it. The can was then raised and admission given; and after the first visitors had gone off with a bellyfull, the feeders increased in the space of an hour to hundreds.

To diversify the trial, Huber procured four small boxes, to the apertures of which, large enough to admit a bee, he fixed shutters or valves, made of card paper, which it was necessary should be forced open in order to gain admission. Honey being put into them, they were placed at the distance of two hundred paces from the apiary. In half an hour, bees were seen arriving; carefully traversing the boxes, they soon discovered the openings, pressed against the valves, and reached the honey. This is a striking instance of the delicacy of smell in these insects, as not only was the honey quite concealed from view, but its odorous effluvia, from being covered and disguised in the experiment, could not be much diffused. We repeated successfully the same experiment. In fact, after the first trial, we had no doubt of the issue of the second; for if once the sense of smell in the bees ascertained the existence and situation of the honey, we had seen enough of their ingenuity in other cases, not to doubt of their success in obtaining entrance. In endeavoring to ascertain the precise situation of the organ, there is considerable difficulty, and our curiosity cannot be easily gratified, without some sacrifice of bee-life. Huber's experiment to ascertain this point, is full of interest, and we recommend a perusal of the account of it as detailed in his work. He dipped a pencil in oil of turpentine, a sub-

stance very disagreeable to insects, and presented it to the thorax, the stigmatæ, the abdomen, the eyes, and the proboscis, without the bee betraying the slightest symptom of uneasy feeling. It was otherwise when he held it to the mouth; it started, left the honey by which it had been enticed, and was on the point of taking flight when the pencil was withdrawn. He next filled the mouth with flour paste, when the insect seemed to have lost the sense of smell altogether. Honey did not attract it, nor did offensive odors, even the formidable turpentine, annoy it. The organ of smell, therefore, appears to reside in the mouth, or in the parts depending on it. To those who may wish to repeat this experiment, we would recommend that they previously deprive the bee under operation of a portion of its sting, which may be easily done by forcing the insect to extend it, and then snipping it off with a pair of scissors; the excision will not vitally injure the insect, and will give confidence to the experimenter.

We cannot conclude this disquisition on the sense of smell in bees, without gratifying our readers by extracting from Dr. Bevan's work, a remarkable instance of its acuteness and delicacy; and which was communicated to him by the son of the gentleman who was the subject of it. It is generally believed that bees have an antipathy to particular individuals, arising, probably, from some peculiar odor about them, which, though not discernable by or unpleasant to man, may be so to this sensitive insect: "M. de Hofer, Aulic Counsellor to the Grand Duke of Baden, had for years been a proprietor and admirer of bees, and rivaled Wildman in the power he possesed of approaching them with impunity. He would at any time search for the queen, and taking hold of her gently, place her on his hand. But he was unfortunately attacked with a violent fever, and long confined by it. On his recovery he attempted to resume his favorite amusement among the bees, returning to them with all the confidence and pleasure which he had felt on former occasions; when, to his great surprise and disappointment, he discovered that he was no longer in possession of their favor; and that instead of being received by them as an old friend, he was treated as a trespasser; nor was he ever able after this period to perform any operation with them, or to approach within their precincts, without exciting their anger. Here then it is pretty evident, that some change had taken place in the Counsellor's secretions in consequence of the fever, which though not noticeable by his friends, was offensive to the olfactory nerves of the bees.—*Dunbar.*

Waldridge, a German writer, says he saw forty large bee hives filled with honey, to the amount of seventy pounds each, in one fortnight, by being placed near a large field of buckwheat in flower.

Water is an article essentially necessary, in large quantities, for bees during the brooding season. They cannot subsist and nourish their young if they cannot have access to water.

Color in Insects.

On the subject of color, many vague and crude ideas have prevailed, and much that appears very nonsensical has been written. Latreille is the *least* theoretical writer on the subject, and he, for some reason not clearly explained, excludes *green* from the list of colors. Without, however, criticising the views of others, we will, in a few words, explain our own.

Black in all its varieties, appears to proceed from the absence of color, and can be produced by the exclusion of light. Different hues of black may be produced by throwing shade on other colors. A deep shade of brown on blue will produce an indigo; on red will produce a brown, &c. Thus blacks and browns originate in nature by a deficiency of light.

White is the presence of light, and the completeness and perfection of color; other colors are subsidiary to it, and component parts requisite to its perfect developement.

The component parts of white are six—red, orange, yellow, green, blue, and violet. If these colors be arranged around a circle, it will occur at once to persons unacquainted with optics that this location of colors is in accordance with nature:

RED,

VIOLET, ORANGE,

WHITE,

BLUE, YELLOW,

GREEN.

In tracing these colors round the circle it will be evident that there is no gap. Neither of the six colors could be omitted, or its place occupied by another. It will also be noticed that red, yellow, and blue are of greater integrity than orange, green, and violet, which are indebted for their characters to the color on either side of them. Further, it will at once be admitted that a white is equally related to all; it partakes of the characters of all, and is composed of all, besides having a perfection and superiority peculiar to itself.

The following tests of the peculiar variations of these colors, as developed on the surface of insects, will be found useful in reading technical descriptions.

BLACKS—piceous or *piceus*, the color of pitch; atrous or *ater*, the color of liquid ink; it is also occasionally written *aterrimus;* nigrous or *niger*, the color of lampblack; fuliginous or *fuliginosus*, the color of soot; blackish or *nigricans*, is an impure black; smoky or *fumous*, as if tinged with smoke.

BROWNS—fuscous or *fuscus*, the color of the otter; bay or badius, and chestnut or *castaneus*, are nearly identical; they both imply a color like that of seasoned mahogany, or a bay

horse, or a horse-chestnut; testaceous or *testaceus*, or *lateritius*, are synonomous, but used with rather a diversity of meaning from authors being unacquainted with the meaning of the words in Latin. The color to which they should properly be confined is that of brick-dust. Ferruginous or *ferrugineous*, is rust-colored or brown with a good deal of red in it.

REDS—rufous or *rufus*, the color of copper; sanguineous, or *sanguineus*, is the color of blood; rubrous or *ruber*, is a clear, unmixed red; miniatous or *miniatus*, the color of red lead; coccineous or *coccineus*, is the most brilliant red, the colorof the blossom of the horse-shoe geranium; roseous or *roseus*, is the color of the rose: puniceous or *puniceus*, is a red, inclining to orange.

YELLOWS—golden-yellow, orange, or *aureus*, the color of an orange; croceous or *croceus*, the color of the blossom of a crocus, rather brighter than orange: flaveous or *flavus*, a pure, unmixed yellow, the color of the blossom of a sunflower; stramineous or *stramineus*, paler than the last, the color of straw, but rather brighter and purer; sulphureous or *sulphureus*, a pale. delicate yellow, the color of powdered brimstone; luteous, or *luteus*, the color of the yolk of an egg: lutose or *lutosus*, the color of yellow clay; tawny or *fulvus*, the color of the lion.

GREEN—glaucous or *glaucus*, is that pale grey green which is the usual color of the sea; prasinous or *prasinus*, is the color of the leaves of leeks; olive or *olivarius*, is the color of olives, a dull green, or a green with brown in it.

BLUES—cæruleus or *cæruleus*, is the color of the sky; cyaneous or *cyaneus*, a pure bright blue, the color of the blossom of the *Centaurea Cyanus*. This color has been erroneously described as that of indigo. Cæsious, or *cæsius* is an impure, greyish blue; violaceous or *violaceus*, has a mixture of red in it, and is precisely the color of the purple violet; frosted or *pruinosus*, expresses that color which objects possess when covered with a light coat of hoar frost; it may be said to approximate to a blue grey.

WHITES—albous or *albus*, is a pure white; whitish or *albidus*, is a dirty, or impure white; grey or *canus*, the color of grey hair, and more properly confined to descriptions of hair; cinereous or *cinereus*, the blue grey color of ashes; cretaceous or *cretaceus*, the white of chalk, or white with a slight tint of yellow ochre; niveous or *niveus*, is a brilliant, snowy white.

Besides these there are various metallic colors common in insects, as silvery or *argentius*, brassy or *cheneus*, likewise written *aneus*, and then used to imply a bright gold-green; the Latin word *smaragdinus* implies a still more intense degree of the same color; coppery, or *cupreus;* and steel blue, or *chalybeus*.

The degree of intensity in a color is usually implied by the addition of an adjective; thus *saturatus* implies that a color is very deep and full; *dilatus* implies that it is pale; again, *latus*, very bright, and *obsoletus*, very dull or indistinct, are contrasted in the same manner, and may, by altering the termination, be used adverbially; thus *læte*, *cupreus*, *obsolete*, *glaucus; saturatus* and *dilutus* do not allow this change.

A diversity of color occurs very frequently in the same insect, and the shape or limit of a color is impressed by a descriptive word; as a spot, or *macula*, signifying a roundish or angular mark, not elongated in any direction. A stripe, or *plaga*, is the term used when the spot is more elongated; a fillet, or a *vitta*, is a longitudinal stripe, and a band, or *fascia* is a transverse one.

The terms used to express shape should be precisely in accordance with those used by the Latin authors. Their copious language may be readily applied to any figures which we may meet, and technical nomenclature in this branch of the subject involves the description in obscurity instead of elucidating it.

The characters impressed in the surface of the skeleton are highly important, and afford excellent guides for the discrimination of species. As a more minute detail of these appears indispensable, the following are the principal variations:

Smooth, *lævis*, or *lævigatus*, is when the surface is perfectly smooth, without depression or elevation; shining, *nitidus*, or *lucidus*, when the surface is polished as a mirror; rough, *asper* or *scaber*, when covered with an irregular rugosity; pustulose, or *pustulosus*, when covered with pustules resembling those occasioned by the small pox; muricated, or *muricatus*, is when these pustules are pointed, and *echinatus* when they are produced into spines; verrucose, or *verrucosus*, when covered with tubercles resembling warts; punctured, or *punctus*, is when the surface has the appearance of having been thickly punctured by the point of a pin, the pin not passing through, but simply making impressions; punctured in lines, or *striopunctus*, is when these punctures are arranged in longitudinal lines; reticulate, or *reticulatus*, when tolerably smooth, yet covered with something like network; vermiculate, or *vermiculatus*, when covered with tortuous markings like worm-eaten wood; striate, or *striatus*, is when marked with longitudinal impressed lines; and *punctostriatus* is when these lines are themselves punctured; caniculate, or *caniculatus*, is when the impressed lines are coarser and deeper than the foregoing; and sulcate, or *sulcatus*, is when they are still deeper, resembling furrows; lineate, or *lineatus*, has lines in the same degree as *striatus*, but the lines instead of being impressed; are raised above the surface; keeled, or *carinatus*, is when these raised lines are fewer and more elevated; and chained, or *catenatus*, is when the space between two impressed lines is divided into oblong elevations, and is supposed to resemble a chain.

A surface is called tomentose or *lanuginosus*, when covered with a thick down; sericeous, or *sericatus*, when the down is short, thick, and silky; villose or *villosus*, when the surface is covered with longer and more distinct hairs; hirsute or *hirsutus*, when covered with long, shaggy hair; crinite or *crinitus*, when the hair is very long and thin; squamous, or *squameus*, when covered with distinct scales.—*Newman*.

Bee Culture in Cottage Hives.

No. 4.

The particular method or system to be adopted and pursued in practical beeculture, depends in part on the honey resources of the district, and in part on the pecuniary resources of the apiarian. In a poor honey district it is not advisable to begin operations on a large scale, especially if other bee keepers are already engaged there in the business. And as the establishment of an apiary, even on a moderate scale, involves the investment of some capital, whoever would engage in the enterprise should be well assured that he possesses the means requisite for its due prosecution to the extent he contemplates. We would advise every beginner to start with a small number of stocks, especially if he is yet a novice, who must of course expect to pay tuition fees, in the form of disappointments and losses, before he can hope to become an expert. If he begins with a small stock, his losses can in no event be heavy, and will be amply recompensed by the experience acquired. He should also, at the outset, fix on a definite number of stocks, in his own mind, to which he will limit his proposed apiary, that he may have a precise object in view to the attainment of which his efforts may be directed. As he proceeds in increasing his stocks, he should determine that the greater portion of them shall always be devoted to the accumulation of stores, and the smaller only to the multiplication of colonies—the latter being intended as the reserve from which the former are to be re-enforced or increased, as occasion demands or his own purposes require. He may, from the first, aim at a larger or smaller number in the aggregate, extending or reducing his stock, as time and experience shall justify. But it must ever be a fundamental maxim with him, that beeculture is not to be prosecuted at haphazard, but conducted on a well-digested and systematized plan. He will thus seek to restrict and repress natural swarming, so as to make it subservient to his own views and interests—suppressing after-swarms altogether, when feasible, or reuniting them with their parent stocks. It is only by controlling and regulating the natural impulses of the bees, that he can turn their labors properly to account. Yet he must at all times be prepared and willing to make some seeming sacrifices to secure the ultimate prosperity of his apiary. He must not expect to increase the number of his colonies largely and reap a bountiful supply of honey in the same season. Honey must remain a secondary object with him till his apiary contains the desired number of strong stocks; and a very rapid multiplicatien of stocks can only be attempted by one who is able and willing to incur the expense of liberal and prolonged feeding—which is always attended with trouble and expense.

We propose now to give the needed instructions to enable a beginner who proposes to cultivate bees on a moderate scale, in cottage hives, to manage them successfully, and establish an apiary of a dozen hives in the shortest time.

He who wishes to become an intelligent, practical beekeeper must, in the first place, acquaint himself thoroughly with the natural history of the insect—not as it is hitherto taught in treatises on entomology, but as it is presented in the works of scientific apiarians. Without such knowledge, well digested, he will be continually liable to make mistakes—doing what he should not do, omitting to do what he ought to do, or doing it at the wrong time. Let this be his preparatory study, and having thus qualified himself for work, let him in the following spring, say the month of April, purchase two good stocks of bees, such as are well stored with honey and contain much brood. They should be procured from an apiary at least a mile distant from his residence, and should before purchasing, be subjected to an examination on some mild day when the bees are flying briskly. Stocks whose bees are flying in and out freely, carrying in pollen plentifully, and showing not only life, but spirit and energy, should be picked out for further scrutiny. Turn up such a hive gently, and while doing so judge by its weight whether it is still well supplied with honey; puff a few whiffs of smoke among the bees to drive them back, and see whether there is brood in the worker combs, and ascertain whether there are bees enough remaining to fill the passages between at least four of the combs. If no brood can be seen in the worker combs, or if what is seen is capped with protuberant convex covers, the stock should be rejected, as either having no queen or one producing drone brood only. But if brood sealed with flat covers is seen in the worker combs, and the hive is populous, with plenty of honey, or the seller will guarantee that there is enough of the latter in store to carry the stock safely to the middle of May, there can scarcely be any risk in purchasing it, at such price as is current in the neighborhood. It will be much cheaper, in the end, to pay a very liberal price for stocks that bear rigid examination, than take feeble or ill-provided ones as a gift.

When the purchased hives are to be removed, they should be inverted in the evening, after the bees have ceased to fly, and a piece of coarse muslin or linen drawn tightly over the opening so as to confine the bees, and secured by fastening it to the sides all round with small tacks, so that not a bee can escape during the transportation; and the hives, remaining thus inverted, may be carried at night, in a light spring wagon, without injury to the bees, to the place designed for them. When arrived at their new home, the bees must remain confined till the hives have been turned again and each set temporarily on three triangular blocks placed equidistant on the bottom boards designed to receive them—thus elevating the hives about one inch above these. The tacks in the front must then be drawn, and the cloth drawn down on that side, to give the bees a free passage. If this is done gently, few bees will come out, and the entire mass will soon become quiet, and the cloth, with the supporting blocks can be taken

away early the next morning. If the weather be fair and mild on the following day, the bees will fly and soon begin to gather pollen, as though no removal had taken place; and they may be permitted to work without interference till the approach of the swarming season. If, on the contrary, the weather be cold and raw, as it not unfrequently is at that season, it will greatly encourage the bees, and promote brooding, if a spoonful or two of honey be given to each of the hives every other evening, till they are able to gather supplies from abroad.

For the enlargement of the incipient apiary swarms are now indispensable, and the apiarian must use means to place his hives in a condition to produce these seasonably. Stimulative feeding is eminently conducive to this end; for swarming depends on the early and abundant production of brood, which always keeps even pace with the supplies of pasturage, when a colony has a healthy and prolific queen. But if, as is ordinarily the case, bees are dependent for their supplies solely on natural resources, brooding will usually, and in many districts invariably, be commenced so late in the spring, that the colonies remain too weak to avail themselves properly of the early pasturage however abundant it may be; and the young bees, when they do make their appearance, prove themselves consumers rather than producers. The hoped-for swarms not only fail to come, but the stocks themselves remain too feeble to work to advantage when the spring fairly opens. To obviate this, the bees should be stimulated to commence brooding freely, as early as practicable in April, by feeding them on the evening of every other day with a mixture of two parts honey and one part water, slightly warmed. Feeble stocks, deficient in stores, should be liberally fed with this diluted honey, giving them a gill as a dose at first, and gradually increasing the quantity to half a pint. When honey cannot be procured for this purpose, good brown sugar dissolved in water, and boiled down to the consistence of syrup, may be used as a substitute. Baron Ehrenfels was in the habit of feeding all his stocks in this manner, every spring—not excepting even such as had ample stores remaining, though to such the food was administered only every third or fourth evening.

If they have not previously been removed, all supers and ekes must at this time be taken away, and access to surplus honey receptacles be prevented. Excepting during the warmer hours of the day, when the bees are flying, the entrances of the hives should also be kept warm or contracted to confine the heat, as an elevated temperature is now desirable. Brooding will then be greatly promoted at a period when the bees would otherwise remain to a great extent inactive; and strong swarms may be looked for soon after spring pasturage becomes abundant, if the season be at all propitious.

When a swarm has issued and is hived, the present stock must be immediately removed to a new location, as distant as practicable in the apiary, and the swarm substituted in its place. After-swarming will thus almost invariably be prevented, and both colonies will become good stocks, capable of being wintered without fall feeding. The same course must be pursued when swarms issue in the following year—increasing the apiary to eight stocks, and probably doubling it the year after. Then, if the bee keeper has concluded not further to enlarge his apiary, a different mode of management must be adopted, to turn the labors of the bees to account.

Increase by swarms does not, however, usually proceed thus systematically and by rule—especially if the purchased hives with which the bee keeper begins his operations, were kept in large magazine or store hives. In selecting stocks, therefore, it is judicious not to choose such as are contained in very large hives. Those of smaller dimensions are preferable, if in good condition, populous, and having produced a swarm the previous summer, or a second swarm of that summer, in equally good condition in all respects. Such stocks have young queens, and the latter sort moreover have new combs. Nevertheless, with all this care and caution, and despite of stimulative feeding, swarms do sometimes fail to come—especially in seasons when spring pasturage happens to be unusually abundant. What is to be done in such event? The only resource, then, is to drive out a swarm from each hive; but a novice in beekeeping should not undertake to do this, except with the advice and aid of some experienced person; though we shall fully describe the process in a future number. The driven swarm must then likewise be set where the parent stock stood, and the latter moved to a new location in the apiary. It is very advantageous, when practicable to place swarms, whether natural or driven, in hives furnished with clean empty combs. This effects a great saving in time and honey. If a comb containing brood can also be given to a swarm, it will be very serviceable indeed; and swarms thus supplied will rarely desert their domicile.

There is still another process by which the enlargement of an apiary may be more rapidly effected; but as it is somewhat hazardous and requires experience and great expertness in the operator, we cannot recommend it to a *beginner*. By adopting the above more simple method, he incurs little risk, though a year or two more may be required for him to reach the point at which he aims. The more expeditious method alluded to, while it may prove successful, depends on so many contingencies that it often ends in disappointment and verifies the adage that "haste makes waste," It can only be resorted to when the season is unusually propitious, and in a district where pasturage abounds every year; for should cold and wet weather prevent the bees from gathering stores, the abundance and even superabundance of nectar which the district might furnish are of no avail. Rapid multiplication, in such circumstances, would be ruinous, unless the stocks be properly reunited and fed not only liberally but lavishly. "Furnished lodgings," moreover, which are simply advantages in the case of natural or driven swarms, are altogether indispen-

sable if this precarious "royal road" be chosen. The process is as follows:

The two purchased stocks are to be permitted to swarm naturally, or a swarm is driven out of each in the usual manner, both having previously been put under "high pressure" by stimulative feeding. The parent hive is, in each case, not only to be left standing in its original place, but only about two thirds of the swarm, or if it be a weak one, only about one half of it, must be hived, and the residue of the bees returned to the parent stock. The consequences of this is that the latter will speedily send out one or more afterswarms. The more certainly to secure this result, the parent stock must, moreover, be fed moderately, every evening, even in fine weather, and more plentifully if the weather be foul. A hive thus treated will commonly yield two or three afterswarms—the feeding being continued regularly after the issuing of each. If the first or second of the afterswarms is very populous, a portion of the bees must be returned to the parent stock, as in the first instance; and the afterswarms must in no case be set adjoining the parent stock, but placed in as isolated positions as practicable, that the young queen returning from these excursions may not be lost. These second swarms must likewise be plentifully fed, or, better still, furnished with worker combs containing honey. If such combs cannot be procured, the feeding must be continued regularly during the summer, in order to stimulate the bees to fill their hives with combs, provide stores for the coming winter, and seal up the honey in the cells. It is essential, too, that smaller hives be used, alike for the prime swarms and the afterswarm. Those for the former should be ten or twelve inches in diameter; those for the latter should not exceed eight or nine inches. The bees will more speedily fill such hives with combs, and thus be housed more compactly and more comfortably during the winter, which is highly important for their preservation.

Afterswarms are apt to prove troublesome and vexatious. Sometimes they will desert their hives repeatedly after having entered. Sometimes they will fly around in all directions, refusing to settle, and finally return hurriedly to the parent hive; or if they do settle in a cluster, many bees will speedily leave and return to their old home. Even after the lapse of twenty-four hours similar scenes will again be enacted, thus involving great loss of time and honey. This results from the fact that afterswarms are frequently accompanied by several young queens, each of which has her adherents, and each dreading her rival. The prudent course, therefore, is to place such swarms, immediately after being hived, into a cool and dark cellar or chamber, and letting it remain there till the following morning. By that time the supernumerary queen or queens will have been killed, and the bees have accepted the survivor. This mode of settling the question of sovereignty, is less troublesome than that which is sometimes adopted in such cases, of steeping the swarm in cold water, and then picking out the surplus queens—though this plan may be advantageously resorted to when, for some special reason, the preservation of the young queen is desirable.

By the process just described, an experienced and expert bee keeper can multiply stock more rapidly than that recommended by us. But it requires unremitted attention and care, with very liberal and protracted feeding. Its adoption can only be excusable when the object is to fill up an apiary rapidly, and the apiarian has abundance of honey which he is willing to devote to that end. Nor must it, even in such case, be persevered in after the prime object aimed at has been accomplished, for it is precisely the reverse of a rational system of bee-culture—which contemplates the production of honey. This method, too, is especially precarious, when it is necessary to force the afterswarms by driving, which sometimes happens when, from change of weather or temporary dimunition of pasturage, they fail to issue; or when after issuing they refuse to settle, or return again to the parent hive. Forced swarms must, in such a case, always be put in hives furnished with combs and honey; sent to a distance of at least a mile and a half from the apiary; and well fed subsequently. All these difficulties and vexations, to which this process is peculiarly exposed, are avoided if we adopt and adhere to the one we have first described and recommended.

After the apiarian has attained the normal number of stocks he proposes keeping in his apiary—be it ten, or twelve, or more—multiplication of colonies is no longer to be the primary object with him. These are now to become subsidiary to the production of honey and wax. Nevertheless, should a swarm occasionally issue from one of his stocks, he will hive it as usual, and set it in the place of the parent stock, removing the latter to some distant place in the apiary. Next year one or both of these may be treated either as swarming or as store stocks—for the former of which purposes about one third of the whole number of stocks in the apiary are thenceforward to be annually reserved. These are to be managed in the manner already described, as from them the store stocks in the apiary are constantly recruited, so as to keep up a nearly uniform number of productive colonies from year to year. The remaining two thirds now assume a different character, are kept in larger hives, and are subjected to a different mode of management.

Store or honey hives must be of greater capacity than swarming hives. The latter are, with us, usually from ten to twelve inches in diameter, and from fifteen to twenty inches high. The former we have from fifteen to sixteen inches in diameter, and from twenty-four to thirty-six inches high, being composed of sections or ekes each six or eight inches high. So long as our chief endeavor is to increase the number of our colonies, we use the smaller divisible hives; but when our efforts are directed to the production of honey and wax, we resort to hives of ampler dimensions. The bees must consequently be transferred from the former kind to the latter. We effect this, at the open-

ing of the honey season, by placing one of the sections of the larger size under the small hive containing the stock. All these sections or ekes are of equal size, without bottoms, and with an opening six inches square in the top. The bees, being thus provided with enlarged room early in the season, will rarely incline to swarm; but will usually fill two or more such sections with combs, brood, and honey, in the course of the second summer. In the following year additional sections are set under from time to time, beginning at the opening of the season, and continuing the enlargement till the hive is thirty-six inches high. The original small or narrow hive is now to be removed, and its contents appropriated, if the bee keeper is satisfied that at least forty pounds of honey remain in the store hive, after the removal of the original swarming hive. The bees are now wholly in the large-sized or store hive, the opening in the upper section of which is to be closed with a suitable cover, when the removal is made.

The transfer having thus been effected, we have populous colonies, in well-filled, well-supplied, and spacious domiciles, and are prepared thenceforward to prosecute beeculture steadily with an eye to pecuniary returns.

There are three fundamental rules on which success in bee culture in cottage hives, in districts of the second or third grade, depend.

The first is never prune away empty combs or parts of combs, in the lower sections of either swarming or store hives, unless they have become very mouldy. Nevertheless, if a section has not been entirely filled with comb, it must be removed in autumn. It should, however, be carefully preserved and replaced under the hive in the spring; for the production or renewal of comb involves much labor and a large expenditure of honey—all of which can be saved, if the bees can be furnished with clean empty combs at the opening of the honey season.

The second rule is, the store stocks must invariably retain a double portion of honey for their winter's supply; that is, each must have at least forty pounds of honey in reserve, at the commencement of winter, in a locality where twenty pounds are usually deemed sufficient.

The third rule is, store stocks must never be permitted to swarm. Swarming may be prevented by placing your stocks in some well shaded and well sheltered location; by giving your bees ample room early in spring; and by having the hives duly ventilated.

That internal heat promotes swarming is a conceded point, and if the hives be exposed to the direct rays of the sun, the internal heat must be greatly augmented. Hence hives intended to produce swarms should stand in warm situations, though not exposed to the direct rays of the sun, because such exposure compels them frequently "to hang out" idly without producing the anticipated swarms. Store stocks, on the contrary, should always be placed in cool situations. For them the northern or northeastern side of a building or wall, or the shade of a spreading tree, is to be preferred, while the latter has the advantage, moreover, that it is equally suited to the wants of swarm stocks.

But it may be urged that when we have secured the full number of colonies which we propose to maintain in the apiary, we shall have them all in the warm positions in which they were placed while we were engaged in multiplying stock; and the inquiry will be, how are we to change the location without losing many bees, as these will return to their accustomed stands, and thus weaken the colonies? Some would suppose that after the bees have been confined to their hives for nearly three months in winter, they will have forgotten their previous location and may safely be transferred to any other position in the apiary without risk of loss. This is not altogether correct. We have placed stocks in a dark chamber from the middle of November to the end of March, then removed them to a new location, and still many of the bees returned to their former stand in a neighboring garden, and were lost. To guard against such occurrences, and yet remove the store hives to a more shady locality, where they are to remain permanently, we transfer each parent stock to the desired place, immediately after a swarm has issued, and set the swarm where the parent stock stood. We may repeat, however, that it is not absolutely necessary to have distinct stands for the swarm and the store stocks; because the former should not, any more than the latter, be exposed to the sun during the heat of the day. Any airy situation, with an eastern aspect, when the hives are shaded by trees in the afternoon, is well suited for either or both kinds of stocks. In the absence of trees, recourse may be had to a temporary roof or awning, to shield the store stocks from the sun after ten o'clock in the forenoon.

As the store stocks are or ought to be very populous, it becomes necessary, whenever their hives are filled with comb and brood, that they should have plenty of fresh air at all times, otherwise the bees will be constrained to cluster on the outside, hanging there idly. As a ready means of ventilation, all our hives are provided with openings in the top, six inches square, covered with wire gauze. Over this a piece of board is fixed, which we remove when ventilation is required, and place over the gauze an inverted box, bowl, or flower pot, to exclude light. This suffices for circulation of the air, and light being excluded, the bees do not close up the meshes of the gauze with propolis. The larger the opening in the top the more effectual the ventilation; but if the weather be very warm, and the population very dense, more room may be required. In such case we lift the top board and interpose an empty section between it and the main hive. This facilitates the removal of impure air, and furnishes circulation in all parts of the hive. The wire gauze on the top must be kept covered by an inverted empty box, to exclude light. This arrangement is very efficient and useful during the warm weather; but should a sudden reduction of temperature take place, it will be well to lay a piece of stout cloth on the wire gauze, to keep in the heat. The section thus introduced serves the double pur-

pose of aiding ventilation, and providing storeroom for surplus honey to be removed in autumn. Should the season, though warm, prove so unfavorable that the bees fail to fill the section even partially with honey, it should be removed about the middle of August—carefully preserving any empty combs it may contain. If filled with combs and honey it may still be removed, provided it be ascertained, on careful examination, that the main hive contains at least forty or fifty pounds of honey—the quantity always to be regarded as indispensably requisite for the proper wintering of a colony. To guard against mistake in this matter, we invariably weigh every empty hive and mark its weight on it, as also that of the movable bottom board. There are, moreover, two other points which must be taken into consideration—namely: that in old stocks the combs are always heavier than in new ones; and that they likewisecontain more pollen. We always make an allowance of five pounds for the difference between such hives.

When by the *nadiring* process a store hive has reached its normal height of thirty-six inches, no more sections are added below, but we revet to *supering*—introducing sections above, in the manner just described. Formerly we added sections indifferently, above or below, as seemed most convenient at the time; but long experience has satisfied us that the latter mode of enlarging at times injuriously displaces the brood combs, and is besides objectionable as frequently causing an undue proportion of drone comb. We now invariably enlarge by supering, that is, by inserting sections *above*, after the store hive has been raised to the normal height of thirty-six inches by *nadiring*. The same objection has been urged against the use of narrow hives for swarms, and subsequently enlarging by giving them sections of larger dimensions. But we have never found this disadvantageous in practice. Unusually large swarms may, indeed, with perfect propriety be at once placed in the wide hives; but it is then indispensable that they be fed liberally in an unfavorable season, to enable them to build a sufficiency of combs to fill the hive, and store it with honey enough for its support.

If, on rare occasions, a swarm happens to issue from one of our store hives, we at once remove the parent stock to a distance, and set the swarm in its place, as before directed. But this seldom becomes necessary, as long experience has taught us that bees kept in wide and tall hives, and managed as we are in the habit of managing ours, have little disposition to swarm.

We must, however, notice a circumstance which is apt to occur with stocks thus kept from swarming, and which consequently do not renew their queens as frequently as others—that is, the gradual decrease of the queen's fertility, and her death from superannuation. If this takes place in the month of October, or still later in autum, when young queens cannot always be successfully reared and fertilized, the colony is apt to perish. It is one among the ew disadvantages connected with large and opulous stocks, that queenlessness in them is not so readily discovered in the spring, as in smaller or feebler stocks. The queenless bees of a strong stock will often fly as briskly when the spring opens, and carry in pollen as plentifully as others; and their destitute condition will not be readily detected by a novice in bee culture. When discovered, the evil may be remedied by introducing the queen and bees of a nucleus or reserve colony wintered for the purpose—the combs and stores of which may be given to an early spring colony, or preserved for the use of the afterswarms we may choose to preserve.

Beeculture in cottage hives must be conducted in the manner here described, if we would secure regular and permanent success in second-rate honey districts. We must ever restrict our operations to some definite or normal number of store colonies, though the actual number in the apiary may at times be greater or smaller, according to seasons and circumstances. A neglect of or departure from this rule, is literally keeping bees at haphazard, and looking to chance for luck. The result will be a decayed and ruined apiary, and thorough disgust with the whole business. Let every novice carefully read, and re-read and ponder what we have stated in this article. It contains, indeed, the very quintessence of beeculture, in such districts, whether cottage hives or movable comb hives be used. We repeat—*not the hive but the system is the essential matter*, though of course the more convenient and well adapted the implements are, the more easily can our manipulations be performed and our system applied. The intelligent reader will therefore readily excuse some minuteness of detail, and the introduction of remarks and suggestions perhaps more appropriately pertaining to some other branch of the subject.

A few words now, in conclusion, as regards the profits which may be expected from the adoption of the system here proposed. This consists exclusively of the honey and wax with which our bees can supply us; for the traffic in Italian queens suits only those who have time to devote to it and skill to prosecute it. It involves so much trouble, risk, disappointment and vexation, that the Baron of Berlepsch and Mr. Hübler have long since abandoned it as a losing business, and others are preparing to follow their example: The sale of supernumerary stocks may indeed be turned to good account, by those who are so situated as to be able to multiply stocks rapidly, and can find a ready market for all they have to spare. But it is to his honey and wax that the true apiarian must look for his profits, and if he devotes to beeculture the same assiduity and attention that are given to other pursuits by intelligent and diligent men, he may confidently look for satisfactory results from his enterprise.

Repeated observations show that the secretion of honey is powerfully influencesd by the electricity of the atmosphere: and bees never labor more actively than during humid, sultry weather, or when a thunder storm is approaching

For the American Bee Journal.

On the Impregnation of the Eggs of the Queen Bee.

The readers of the AMERICAN BEE JOURNAL will probably be surprised to learn that the true office of the spermatheca in at least one insect, was known nearly two hundred years ago. M. Debeauvoys, in his Guide de L'Apiculteur, 6th edition, Paris, 1863, page 301, says: "In 1630" (date should be 1669) "Malpighi figured and described in the female moth of the silk worm the organs of generation with such precision that modern works give nothing new on the subject."

In volume 2d, of Malpighi's works, which were published at Leyden, in 1683, is a treatise on the silk worm, dedicated to the London Royal Society. In this treatise, which is wonderfully accurate and minute, the external and internal organs of the larva and male and female moth are very fully figured and described.

Plate 12 contains, on a highly magnified scale, a drawing of the ovaries and spermatheca (or as he calls it, *uterus*,) of the female moth, with their adjacent parts.

On page 40, he says, (I abridge his minute description,) that he found a vessel opening into the oviduct, which he believed to be the receptacle for the male sperm, and from the contents of which the eggs were impregnated as they passed from the ovaries.

Taking some eggs from the ovarics of an unimpregnated moth, he found that all which were *above* the spermatheca remained of the sulphur color which characterises unfecundated eggs, while those which were taken from the oviduct *below* the spermatheca, assumed the violet hue, which is the proper color of impregnated eggs.

To make the demonstration of the proper office of the spermatheca more complete, he attempted to fecundate artificially the eggs taken from the ovaries, either by applying to them the contents of the spermatheca, or the sperm taken from the male moth. This experiment failed because he seems to have been ignorant of the fact that the eggs, when exposed to the air, became too dry to admit of impregnation.* Malpighi, having failed in what he thought, if successful, would have been a most happy experiment, (*maxima experiendi felicitas*) committed to the members of the Royal Society the further elucidation of this subject. One of them, as will soon appear, completed the experiment by artificially impregnating the eggs of a virgin moth at the moment they were extruded by her. This author by making no mention of Malpighi in his minute account of his own experiments, failed to give to his able predecessor that credit to which he was so eminently entitled. "*Suum cuique*," "his own to each" should be a sacred motto to all observers and inventors.

*In 1852, as described in my work on bees, edition of 1857, I made an attempt to fecundate artificially some eggs laid by a queen bee in drone cells, and failed from the same cause. Some years afterwards this was successfully done by Donhoff in Germany.

Swammerdam, in his great work, *Biblia Naturæ*, Leyden, 1737, described very minutely and accurately the generative organs of the drone and queen bees, giving a highly magnified drawing of the ovaries of the queen, with their dependent organs. If he had only thought of applying his microscope to the contents of the spermatheca, which organ he had so beautifully depicted, he would have been spared his vain attempts to prove that the eggs of the queen bee were fecundated by a seminal atmosphere, (*aura seminalis*), to produce which he thought required the large number of drones usually found in a hive.

Bazin, (see Debeauvoys, page 304,) who in 1740 had the charge of communicating to the public some profound observations of Reaumur, referring to Malpighi, was certain that the fecundation of the eggs of the queen bee was accomplished in the same way with those of the silk moth, by being bedewed with the sperm which was lodged in the sperm reservoir. It seems strange to us, with our present knowledge, how such demonstrable matters, so important in their practical relations, could have been so long overlooked, not only by beekeepers, but by the most scientific entomologists.

Arthur Dobbs, in a letter published in the Transactions of the Philosophical Society for 1750, vol. 4, p. 536, seems to have been the next person to suggest that the queen had a permanent seminal receptacle. On page 548 he says: "There are two vessels described by Swammerdam in the mother bee, whose plate M. Reaumur has given in his Memoirs, one of which is placed betwixt the two lobes of the ovarium, which he supposes to be a bladder to contain air; the other is a special vessel seated close by the common duct in which the eggs fall from the lobes of the ovarium, which he supposes to ooze out a juice to moisten the eggs in their passage. I take one of these, but most probably the last, to be the reservoir and repository of the male sperm wherein it is lodged in the act of coition, until the eggs are enlarged and pass through the adjoining duct from the two lobes of the ovarium."

The celebrated John Hunter gives a highly interesting explanation of the way in which the eggs of the queen bee are impregnated from the contents of the spermatheca. It may be found in an article entitled "Observation on Bees, by John Hunter, Esq., F. R. S., Read Feb. 23, 1792;" see volume 82 of the Transactions of the Philosophical Society, pages 128-195.

The following extract from Professor Siebold's work, "Parthenogenesis," shows that at the time of the publication of that work he could not have read either Malpigi, Bazin, Dobbs, or this article of Hunter's.

"Although the representation of the male and female sexual organs of the bees have been copied from Swammerdam's *Biblia Naturæ* by various writers upon these insects, and consequently the facts established anatomically were communicated to the apiarians, yet for a long time these truths could not boast of a recognition by all bee keepers. These entomologic investigations probably did not appear sufficiently

significant to the apiarians, because there were still many things in the history of the reproduction of the bees, which could not be explained with this knowledge of the sexual relations of these animals. Many practical apiarians looked upon this anatomical proof of the sexes of bees merely as theoretical stuff, and returned to their so-called practical way, which they imagined to be the right one, without regard to these facts, preferring to explain the different sexual functions in a perfectly arbitrary and unnatural fashion, according to their own individual and often very limited views.

After I had, in the year 1837, ascertained the existence and signification of the seminal receptacle in female insects, and in 1843 called attention to this reservoir of the semen in the queen bee, by the functions of which many phenomena in the reproductive activity of the bees, which had hitherto remained problematical, or had been incorrectly explained, might be properly conceived, these investigations exerted no particular influence upon the perverted views of most of the apiarians. They probably paid no further attention to them, as theoretical stuff, and yet by the recognition of the function of the seminal receptacle, a phenomenon in the bee-hive which had been a source of wonder from time immemorial, could now be correctly explained."

In Hunter's article, pages 185, 186-188, are the following remarks: "In the introduction to this account of bees I observed, that several things in their economy might escape us if we considered them alone, but might be made out in other insects; an instance of this occurs in the impregnation of the female bee. The death of the males in the month of August, so that not one is left, and yet the queen to breed in the month of March, must puzzle any one not acquainted with the mode of impregnation of the females of most insects.

Insects, respecting the males, are of two kinds; one, where the male lives through the winter, as well as the female, and the other where every male of that species dies before the winter comes on; among which may be considered, as a third, those where both male and female die the same year. Of the first, I shall only give the common fly as an instance; of the second, I shall just mention all of the bee tribe; and the third may be illustrated in the silkworm The mode of impregnation in the first, is its being continued uninterruptedly through the whole period of laying eggs, while in the second, the copulation is in store; and, in the third, the female lays up, by the copulation, a store of semen, although the male is alive; of this I shall now give an explanation in the silkmoth, which may be applied to the bee, and many others. In dissecting the female parts of the silk-moth, I discovered a bag, lying on what may be called the vagina, or common oviduct, whose mouth or opening was external, but it had a canal of communication between it and the common oviduct. In dissecting these parts before copulation, I found this bag empty, and when I dissected them after, I found it full."

To know whether the bag in the female silkmoth, which increased at the time of copulation, was filled with the semen of the male, he made the following experiment:

"I took a female moth as soon as she had escaped from the pod, and kept her on a card till she began to lay. I then took females that were fully impregnated before they began to lay, and dissected out that bag which I supposed to be the receptacle for male semen; wetting a camel's hair pencil with this matter, I covered the ova as soon as they passed out of the vagina. These ova were carefully laid on a clean card, and kept till the ensuing season, when they all hatched at the same time with those naturally impregnated. This proves that this bag is the receptacle for the semen, and gradually decreases as the eggs are laid."

In a note on page 186, Hunter says that "all these experiments on the silk-moth were begun in the summer of 1767," thus showing that seventy years before Siebold, he was acquainted with the existence and signification of the seminal receptacle in female insects. From his remarks on page 172 it is evident that he believed the queen to be impregnated in the open air.

That an unfecundated female could lay eggs which would produce drones only, and that all unfecundated eggs produce drones, is nearly all that we know on this subject in addtion to what we find suggested by Malpigi, Bazin, Dobbs and Hunter.

The production of males from unfecundated eggs is the discovery of the celebrated German apiarian, Dzierzon, and while it has thrown a flood of light upon many hitherto mysterious points in the physiology of the honey bee, some of which evidently perplexed the mind of Aristotle more than 2,200 years ago, it has been of great importance to the bee keeper in the practical management of his apiary.

Prof. Joseph Leidy, of Philadelphia, examined in January and February of 1852, the spermatheca of two fertile queens taken from my apiary. See my communication in the Proceedings of the Society of Natural Sciences, Philadelphia, for February, 1852, p. 49. He also made a microscopic dissection of a drone-laying queen in the autumn of the same year. See 1st edition of my work on the honey bee, published in May, 1853, pp. 37, 43. In August of the same year, see 3d edition of the work, he made an examination of a young queen which had the male organs still adhering to her. In this dissection all the essential characteristics of the impregnated and unimpregnated spermatheca were acurately set forth.

Before these examinations, Dzierzon had set forth their characteristics as seen by him with the naked eye. His conjecture that the poison bag in the worker becomes the spermatheca in the queen, shows that he had not at that time made any use of the microscope. Still he is entitled to full credit for his acute observations, and any one can repeat them both upon impregnated and unimpregnated queens. I frequently make such dissections both with and without the microscope, for the gratification of those who visit my apiary.

Until the publication of Siebold's *Parthenogenesis*, I thought that Prof. Leidy's was the first microscopic dissection of the spermathecas of the queen bees; and therefore the first to put all the facts upon the basis of complete demonstration. From Siebold's work, which is full of the most interesting details on this subject, it appears that in 1843 he had made microscopic dissections upon the spermathecas of impregnated queens. The first microscopic examination made in Europe of the spermatheca of a drone-laying queen was by Leuckart, in March, 1855, on a subject furnished to him by the Baron Von Berlepsch. In July, 1853, Berlepsch sent to Siebold a queen caught entering her hive with visible marks of sexual intercourse.

I have thus given for the information of the bee-beeping public, all the essential facts with which I am acquainted, on points of great practical importance to every apiarian, some of which seemed so directly to overthrow what had hitherto been regarded as first principles in physiology, that only repeated and unquestionable demonstrations could establish them.

L. L. LANGSTROTH.

OXFORD, Butler Co., Ohio.

Whilst the season continues favorable for collecting honey and pollen, bees labor from dawn to dark; and that they never cease to gather stores for their magazines, is not however from a foreknowledge that a season is approaching when their harvest will be denied them; but they are furnished by nature with an impulse for obtaining their food, without thinking or being capable of thinking, of any precautionary measures for that purpose. Their nature requires that they should gather honey and pollen, and they accordingly do so.

Speaking of the antennæ of the queen bee, Huber remarks that according to experiments, "the amputation of one did not effect her instinct; but if both were cut off near the root, these privileged beings, these mothers, so much the object of consideration, lost all their influence; even the instinct of maternity disappeared. Their eggs were no longer deposited in the cells; their mutual animosities were forgot; they passed close together without recognizing each other; and the workers themselves seemed to participate in their indifference."

It is evident that bees act in concert, that their operations tend to one general object, and that they are aware of its being fulfilled. All this cannot be done without some mode of communication with each other; but as all their performances are in the dark, it is extremely difficult to conceive how they can know each others proceedings.

Heat is the great principle which animates insects, and cold is the bane of their existence. Heat has great influence in promoting the hatching and maturing of the young brood in spring, by which a colony is rendered more numerous.

For the American Bee Journal.

Do young queens ever make hymeneal excursions prior to the third day after being established as the head of a colony? APIS.

[The general impression, based on observation, is, that such excursions are not made before the third day, or until the young queen is at least three days old. Recorded facts, however, show that there is no definite and uniform period to which this can be limited; and the following statement given by Mr. Stary, in a late number of the *Bienenzeitung*, shows that there may be exceptional cases when the excursion is made within a day, nay, within an hour, after the young queen leaves the royal cell:

"On the morning of the 26th of June, 1863, I heard an emerged queen *teeting* in a hive from which a prime swarm had issued on the 17th of that month; and I heard, also, clearly and distinctly, the *quawking* responses of two other young queens yet remaining in their cells. I heard this repeatedly from five to eight o'clock in the forenoon. At about nine o'clock the expected swarm issued, accompanied by two queens, one of which I immediately seized and killed. After hiving the swarm and placing it on its stand, which may have taken thirty minutes, I returned to the parent hive to make my customary examination. I had scarcely got there when I saw a young queen issue and perambulate the alighting board, preparatory to making her intended excursion. As I intended to Italianize that colony, I caught this queen and destroyed her, substituting for her a fertile Italian queen, which was at once kindly received and accepted."]

For the American Bee Journal.

Wintering Stocks.

QUERY.—Can bees be wintered to advantage in a house built as follows: Walls of plank, with eighteen inches of saw dust between them? If so, how many stocks in a room twelve feet square, eight feet high, well ventilated, in total darkness, with eighteen inches of sawdust on floor and in ceiling? P. W.

CARTHAGE, Ind.

[We think that stocks in good condition, when introduced, would winter well in such a repository. The room would probably accommodate sixty stocks, if properly placed. We cannot speak from any experience of our own of this mode of wintering bees, having always kept our own stocks on their summer stands the year round.]

It seems to be a matter of some doubt and uncertainty whether bees enjoy the sense of hearing; but their organs of sight appear to be very perfect, especially as respects distant objects.

THE AMERICAN BEE JOURNAL.

WASHINGTON, OCTOBER, 1866.

☞ THE AMERICAN BEE JOURNAL is now published monthly, in the City of Washington, (D. C.,) and all communications should be addressed to the Editor, at that place.

Foulbrood.

We learn from various quarters that this nauseous and fatal malady is becoming more widely diffused in the country, and that the medicaments and modes of treatment resorted to for its eradication and cure have either proved inefficient, or partially unavailable.

We never had more than one case of the genuine disease in our apiary, and that occurred about two years ago, under circumstances which precluded any attempt to investigate its character or employ any of the remedies recommended or suggested. We were about leaving home when its existence in one of our colonies was discovered, and could only direct that the bees should be immediately suffocated, the combs burned, the hive scalded, closed, and placed where bees could not have access to it. This was done, and the disease was thus prevented from spreading to other colonies in our own or neighboring apiaries, as no symptoms of foulbrood made their appearance there since.—Where and while the disease is still confined to a single colony, we would advise the prompt adoption of the same process, as the least troublesome and ultimately the cheapest mode of arresting it. Only where it is already extensively diffused in an apiary or in a neighborhood or district, would we be willing to resort to any of the proposed remedies or experiments for its extirpation. And for the benefit of beekeepers thus situated, we copy from the proceedings of the General Convention of German Apiarians, held at Brünn, in Austria, in September, 1865, the following statements made by the Rev. Mr. Schiebele, of Schönburg, in Moravia:

"I regard foulbrood as originating in reality from a diseased condition of the bees. Of this any one can easily satisfy himself by the fact that a foulbroody colony, if transferred to a clean hive and constrained to build new combs, is by no means cured, though it may have been first made to suffer hunger and then fed with pure honey. In such case the malady will certainly re-appear, unless it has been of very recent origin and resulted from chilling the brood —thus killing it—and this was removed before putrefaction reached an infectious or contageous form. Foulbrood, as it presented itself in my hives, did not occur in only one or two cells; but in all the combs the greater portion of the brood, in the various stages of developement, alike in sealed and unsealed cells, was in a putrid state. In some of the cells the brood had only recently died; in others the putrid matter becoming dried up had been cast out by the bees, as was evident from the dark brown fœtid powder found on the bottom boards. The disease had therefore existed several weeks already, perhaps several months, when it was discovered. Nay, in one instance, when the bees were in a common straw hive, and their diseased condition was not ascertained till late in autumn, its treatment had to be deferred till spring, so that a large portion of the affected combs remained in it during the whole winter. The disease extended from the tip of the combs to near their base, though here and there some few patches of healthy brood were interspersed. Very few bees were hatched, the population of the hive was constantly decreasing, and the offensive odor issuing from the hive, proclaimed the existence of foulbrood in its worst form.

"The process which has, with me, been *invariably* successful in effecting a cure, is as follows: Drive out the bees and cut out all the combs so completely that not a cell shall be left, and new combs will have to be built. The queen having thus no immediate opportunity to deposit eggs, return the bees to the hive and let them remain in quiet till the following morning. They will at once proceed to cleanse the interior, preparatory to resuming regular work. Now boil in water some thyme and balm leaves, say a handful of each, taken in a green state if procurable, adding a few leaves of Socatrine aloes. Strain the liquor through a cloth, add an equal quantity of pure honey, and boil down to the consistence of syrup, skimming it carefully the while. Then scrape or pulverize a piece of asafœtida of the size of a hazelnut, and another of camphor, of the size of a large pea, adding half a teaspoonful of epsom salt. Mix the whole well, and pour on it a pint of the previously prepared decoction, adding two or three drops of oil of turpentine, and stirring the whole thoroughly. While yet lukewarm, give this to the diseased bees in a common feeding box. The odor of the honey will at once attract them, and as they are now hungry, they will greedily partake of it. In a short time, however, most of them will retire in apparent disgust, though hunger will induce a number of them to continue eating, till a fourth or third part of the first dose is carried up. The remainder of this prepared food must then be warmed, and offered to them. The smell of the asafœtida and camphor having by this time thoroughly pervaded the hive, and the bees having become accustomed to it, the food will now be carried up nearly as fast as cells are built to receive it. They will appropriate more and more of it at each successive feeding, and in a short time readily take up all that is offered. Whenever the feeding box needs replenishing, the asafœtida and camphor remaining depos-

ited in it, must be stirred, a little more Epsom salt added, before the warmed food is poured on, and the whole well stirred again. Care must be taken while feeding, not to attract the bees of other colonies, so as to induce attempts at robbing, as the bees under treatment are not in condition to resist an attack successfully. By their more energetic and active flight, and by the speedy renewal of their combs, the bees will soon manifest the efficacy of this treatment; and the healthy development of brood will show that the cure is thorough, though the bees continue in the hive in which the disease originated.

I submit this prescription, which I have *always* found effectual, that other beekeepers in whose apiaries foulbrood prevails, may also test it—though I feel entire confidence that none will make the experiment without satisfactory results. I may add that I do not presume to say that all the ingredients mentioned are indispensably required, but hitherto I have not omitted any, when preparing the mixture—the whole used together, as directed, having always accomplished a thorough cure."

Mr. Schieberle does not believe that the infection is communicated by the use of honey derived from stocks in which the disease exists. One of his colonies having accidentally obtained access to such honey, carried the whole of it into their hive without becoming diseased. He also states that he has used such honey in feeding healthy stocks without injurious results. His opinion is that the diffusion of the malady is effected by diseased bees, which emigrate from infected stocks to such as are still healthy, and abide there. Respecting the original source or cause of the disease, he hazards no conjecture.

His communication was received with great applause by the convention.

☞Since the foregoing article was put in type, we have learned that at Pforzheim, in Baden, a colony of bees suffering from foulbrood has been treated in the manner directed by Mr. Schieberle, and that no symptoms of this disease were perceptible weeks afterward, though the newly built combs contained an abundance of sealed brood.

The Egyptian Bee.

Through the agency of the "Society of Acclimatization," at Berlin, in Prussia, the variety of the honey bee prevalent in Egypt, has been imparted and introduced in Germany. Mr. Vogel, of Custrin, in whose charge the imported colony was placed by the society, has been successful in multiplying stock, and preserving its purity; and several young queens have already been sent to England.

We understand that arrangements have been made to bring this variety to this country at an early day. It differs from both the common and the Italian bee, in size and marking, and is stated to be quite as gentle in temperament as the latter, while the breed is more easily kept pure.

We have full accounts of this bee—the *apis fasciata*—in Prof. Gerstaker's essay on the geographical distribution of the honey, and on Mr. Vogel's descriptive treatise—from which we shall furnish our readers with such details, in the next and succeeding numbers of this journal, as cannot fail to prove interesting.

We learn that an extension of the Rev. L. L. Langstroth's patent for his movable comb hive, has been granted by the Commissioner of Patents. By the terms of the patent laws the extension is for seven years from the 5th day of October, 1866, inclusive. *See his advertisement on the cover.*

☞We propose preparing, and publishing in successive numbers of the BEE JOURNAL, a list of all the existing patents relating to beehives, with illustrative drawings, and giving the claims in each case in detail. This will enable our readers to inform themselves of the peculiar features of each invention, and to understand precisely what the patent is intended to cover.

The study of the natural history of the bee furnishes useful instruction to the human mind. The singularity of the means which the Author of nature has chosen for preserving the species of bees, is particularly observable. The mothers, which in almost all other instances, are the watchful and tender nurses of their young, we find in this instance only give them birth. The duty of rearing them is committed to substitutes, the workers, and these, as nursing mothers, manifest precisely the same affection towards the young of their species, as we observe in the real mothers of other animals.

It is the working bees that form the great class on which the welfare of a hive principally depends. Without their incessant aid, the males, the queen, and even the brood itself, would quickly perish. And while the presence of a queen is essential to their safety, they are no less requisite for her preservation.

It is contrary to the nature of bees to suffer any uncleanly substance to remain in their hives. Some of them act the part of scavengers by freeing the hive of all nuisances.

For the American Bee Journal.

Introducing Queens.

Of all the plans given to introducing queens, I prefer the following, and consider it one of the most successful ones: Destroy the reigning queen, and as soon as the young queen raised by the bees has destroyed all the queen cells, and before she has become fertile, destroy her also. Secure the queen to be introduced in a queen cage; place her among the bees; leave her thus for twenty-four hours, and then liberate her, and she will be well received nine times out of ten. The queen must have honey in the cage. It will not do to depend on the bees to feed her.

The reason why I think this plan is the best, is that the bees have last been acquainted with an unimpregnated queen, and will more readily accept a fertile one. I have often introduced queens after depriving the bees of a queen just hatched, and without confining her, with good success. But let this be attempted when a fertile, laying queen is removed, and we will fail nine times out of ten. The disposition of the bees, however, is so various, that no rule can be given that can always be relied on. I will give an instance of a stubborn colony that came under my observation this season. A swarm of bees was deprived of its queen. In four days the queen cells were all destroyed, and a caged Italian queen introduced. The bees refused to receive her for four days, when they had no more power to raise queens. The queen was then released. Next morning I found her dead on the floor board. Another Italian queen was given them in a cage. They could not be induced to accept her. When the queen was taken away, the bees manifested all the symptoms of queenlessness, and the most stringent attachment to the queen. They would rush out of the hive, and fill the air in every direction in search of her. The cage was then placed on the limb of a tree, and the bees soon clustered around her the same as a swarm. I then liberated her, and returned the bees to their hive. In an hour after I found the queen enclosed in a compact cluster of bees, and in the last extremity. I thought I would try Mr. Hübler's plan, as given in the first volume of the Bee Journal. I fumigated the bees to such an extent that some of them did not revive, and placed the queen among them. Next morning I found her dead.*

R. B. Oldt.

New Berlin, Pa., September 29, 1860.

*Probably this queen had been fatally injured when enclosed in the cluster from which she was rescued before the fumigation of the workers.—Ed.

Bees collect some part of their stores from what is commonly called honey dew. This is an exhudation found on the leaves of trees, in very hot, sultry weather. The chestnut and oak are the principal trees which produce this substancein any quantity. It is often found, also, on the maple. the sycamore, the linden, the hazel, and the bramble.

For the American Bee Journal.

Profits of Bee-keeping.

I will give you a few figures about my bees for two years. On the 4th of August, 1864, I bought at a sale two hives of Italian bees for thirty dollars..... $30.00
April, 1865, I bought five extra hives, Langstroth's patent..... 25.00
April, 1866, I bought ten hives of I. I. Rossels and extra boxes..... 40.00

Total expenditure in two years..... $95.00

Contra, Cr.

In the summer of 1865, I sold honey amounting to..... $40.00
Used in the family..... 30.00
And sold two stocks for..... 30.00
Sept., 1866, sold honey to date, for.... 50.00
Honey on hand worth..... 40.00
Used in the family..... 20.00
Have on hand seven stocks, (for which I am offered $25.00 each,) worth 140.00
Eight hives not used..... 32.00

Total amount..... $382.00
Balance..... $287.00

The first season, 1865, I had five swarms from two old stocks; and in the second, only two swarms from five stocks. One stock that did not swarm, gave me fourteen boxes of honey, each containing five and a half pounds, or seventy-seven pounds in all. My hives are at this time all full of bees and honey. E. D. P.

Dayton, Ohio.

For the American Bee Journal.

To Preserve Queens and Queen Cells.

For the benefit of the readers of the Bee Journal, I will give my experience in preserving queen cells and queens. It will be found beneficial at least to those who have Italian bees. After the bees have swarmed, and just before the young queen in the old stock is matured, cut out a queen cell. Trim off the comb from the cell as much as possible. Secure this cell in a queen cage, made as follows: roll up a piece of wire gauze large enough to fit around a large closed thimble; fasten together and secure to the thimble with thin annealed wire; close the other end with a wooden stopper, first filling the thimble with honey. The thimble should have wire gauze over the opening, to prevent the queen from bedaubing herself with honey. A piece of honey-comb, with unsealed honey in the thimble, would probably be better than strained honey. The cage should be placed in the centre of a hive in a perpendicular position. A small piece can be cut out of a comb to receive the cage. The cage should be several inches long when finished, to give the queen plenty of room when hatched. The result and a few of the advantages are these: the queen will hatch, and if she have plenty of honey, she can be kept there till the reigning queen begins to lay. If she should be lost, all

we have to do is to liberate this confined queen, and the bees are at once supplied with a substitute, which having the same smell with the bees, will be well received.

We may thus secure any number of queens, to supply swarms that lose theirs. But to the apiarian that has Italian bees, this plan is of still greater importance. If a few queens are thus secured, and the one that assumes the reigning power in the hive is not of good color, one of these can be substituted in her place; and this noble race can thus be perpetuated in its purity, with the least possible trouble.

I shall attempt to winter queens in this way the coming winter. Of course impregnated queens must be chosen for the purpose. My process shall be the same as with the cells, only a few bees will be confined with the queen. I have no doubt I shall be successful, if the cage is in the *centre* of the cluster, and the queen has plenty of honey for her support. I hope others will try to winter queens in the same manner. If successful, we may often save valuable stocks in the spring, that have lost their queens during the winter. R. B. OLDT.

NEW BERLIN, PA., September 29, 1866.

For the American Bee Journal.

I have kept the honey combs of three hundred hives, three years, in a room nearly air tight, smoked with burning sulphur three times a year. The doors were sealed tight, moth proof.

Having the empty combs, I have taken from three swarms of bees, seventy-five pounds of honey, worth $22.50. From a stock of Italians three hundred pounds or ninety dollars worth was taken, and seventy-five pounds each from two stocks that deserted or died last spring.

ST. CHARLES, ILL. J. M. M.

For the American Bee Journal.

Bees have done tolerably well here this summer. One hive of Italians of Mr. Langstroth's importation, in this neighborhood, produced one hundred and forty-one pounds of surplus honey, and another hive a large box nearly full. M. D.

LEWISBURG, Ohio.

For the American Bee Journal.

Last June I clipped the wings of a black queen to prevent swarming. About a week ago I noticed Italian workers entering and departing quite freely, and no signs that robbing was being perpetrated. I could also see them through the observing glass, quite at home in the hive. One of my neighbors has two hives which are affected in the same manner. One of his queens is a young one, and may have met an Italian drone; but mine could not. Can you explain the mystery?

Are drones allowed to visit any hive they please? I have known Italian drones to be in hives where the queen was a native; and have seen dead ones that tried to push through a non-swarmer that was applied to a hive to keep black ones in, so that they might not mate with Italian queens. Would they have been well received if they had succeeded in getting in?

I intend wintering my bees in a clump, as advised by Mr. Langstroth. Ought I to confine them to the hives? My hives have wire ventilation in the rear.

How many strong stocks would an acre of buckwheat support while in blossom?

CONCORD, Mass., Sept. 18. H. F. W.

REMARKS.

1. Bees are by no means such inhospitable creatures as was formerly supposed. This was clearly demonstrated when the Italian variety was introduced. If hives of Italians be placed among common stocks in an apiary they will speedily mingle, and individuals of the one variety will be observed in the hives of the other, laboring as assiduously as though "to the manor born" and originally domicilated there.

2. During the season when drones are bred and tolerated by the workers, they will be well received in any hive they may choose to enter —whether of the Italian or common stocks.

s, When wintered in a clump, cellar, or dark chamber, bees should not be confined to their hives. The entrance must always be left open; and if cottage hives are used, these should be inverted, and left in that position till spring opens.

4. Buckwheat is an exceedingly precarious honey plant. In some soils and seasons it entirely fails to yield any; and the product is every year so dependent on circumstances beyond control, that it is impossible to say what number of stocks could be supported by an acre of it while in blossom.—ED.

Every living thing, from man down to an ephemeral insect, pursues the bee to its destruction for the sake of the honey that is deposited in its cells, or secreted in its honey bag. To obtain that which the bee is carrying to its hive, numerous birds and insects are on the watch, and an incredible number of bees fall victims in consequence, to their enemies. Besides this, there are frequent changes in the weather, sudden showers, and violent gusts of wind; and then there is the liability to fall into rivers; and thus perish. Hence we may boldly assert that few bees attain to old age, or die from an exhaustion of vital forces.

Bees have a sort of language among themselves, whereby they know each other's wants, as in building their combs, unloading the laborers, feeding each other, &c. They also foreknow the approach of a storm, and will sound an alarm when anything injurious disturbs their habitation. Such sounds will be instantly understood and answered by the whole hive.

Reaumur calculated that, within one hour, three thousand bees returned from their collections, to a hive whose population did not exceed eighteen thousand; and Swammerdam found nearly four thousand cells constructed in six days, by a new swarm, consisting of less than six thousand workers.